ABSTRACT

Population growth and economic development cause increasing nutrient releases to streams and estuaries from agriculture, urbanization, and industrialization. Swamps and bottomlands along Coastal Plain streams are capable of removing much of this increased nutrient load. The wetlands along streams, generally termed riparian wetlands, normally have wide, flat floodplains which provide very large areas of soil surface well adapted for processing plant nutrients. This study aimed to increase understanding of the efficiency with which riparian wetlands strip out nitrogen and phosphorus from municipal wastewater effluents.

The initial phase of the study was devoted to selection of sites which were representative of the many forested wetlands impacted by municipal wastewaters in eastern North Carolina. Two swamp-stream sites were selected for intensive study, Bridgers Creek which receives wastewater from the town of Rich Square, and Deep Creek which similarly serves Scotland Neck. Samples of water were collected at about ten stations above, at, and below wastewater outfalls every three weeks for nearly two years. The extensive study utilized sites near Clarkton, Pink Hill, LaGrange, Walstonburg, Enfield, Macclesfield, and Lewiston-Woodville. They were sampled only quarterly for one year to determine variability among bottomland systems. Field measurements were made of water temperature, conductivity, dissolved oxygen, and pH. At the two intensive sites, stream discharges were also estimated. Grab samples of water were collected and returned to the laboratory for measurements of chloride and nutrient concentrations, including nitrate, ammonium, total N, phosphate, and total P. The chloride concentrations were used to make corrections for in-stream dilution, permitting calculation of net downstream changes in nutrient concentrations.

The receiving streams usually had waters much lower in conductivity and nutrients than the wastewater. The effluent generally increased these parameters just below the outfall, but concentrations decreased again downstream more rapidly than was expected based on dilution alone, demonstrating net nutrient removal. Median net removal efficiencies for ammonium, total N, phosphate, and total P within about 4 km below the Rich Square and Scotland Neck outfalls ranged from about 50% to 100% of the amounts in the effluent. About 80% of the nitrate was removed in the Deep Creek swamp below Scotland Neck. Rich Square effluent had very low concentrations of nitrate. Nitrate changes relative to the amount in the wastewater there ranged from very high to very low, with no significant median change below the outfall over the period of